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MECHANICS.

66. Proposed by B. F. FINKEL, A. M., M.Sc., Professor of Mathematics and Physics, Drury College. Springfield, Mo.

A conical stick of timber, length a, radius of base r, and density δ, is depressed, apex downward, in a liquid, density δ', so that the base is just level with the liquid. If left free to rise, required the greatest altitude to which it will ascend.

67. Proposed by G. B. M. ZERR, A. M., Ph. D., President and Professor of Mathematics, The Russell College, Lebanon, Va.

Find the horizontal and vertical components of the moon's "disturbing force" for any point on the earth's surface making an angle φ with the line joining the center of the earth to the center of the moon.

⁂ Solutions of these problems should be sent to B. F. Finkel, not later than June 10.

AVERAGE AND PROBABILITY.

63. Proposed by COL. CLARKE.

Three points are taken at random, one on each of the three faces of a tetrahedron; what is the chance that a plane passing through them cuts the fourth edge?

[From *Williamson's Integral Calculus*, page 410.]

64. Proposed by Rev. W. A. WHITWORTH, A. M.

O is a given point within a triangle; P is a random point within the same. The line through O and P is produced so as to divide the triangle into a trapezium and a triangle. Find the average area of this triangle. [From the *Educational Times*, London, Eng.]

⁂ Solutions of these problems should be sent to B. F. Finkel, not later than June 10.

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BOOKS AND PERIODICALS.

Theoretical and Practical Graphics. By Frederick N. Willson, C. E., A. M., Professor in the School of Science, Princeton University. (Author's Edition) 1897. 4to. Pages viii+264+Appendix.

This is a most attractive work, not only conquering graphics entire, but containing much more of highest geometric interest, including a fairly complete course on higher plane curves.

The part of the subject where Church so long held supremacy in America with his Descriptive Geometry justly appreciated for its elegance, is paralleled by Professor Willson in his Chapter I and Chapters IX—XII, 117 pages in all, including 219 figures in the text, where he not only covers with equal conciseness and elegance the matter of Church's 138 pages of text and 21 pages of illustrations (102 figures), but in addition has treated many new and important matters, such as the Conoid of Pluecker (articles 333, 356, 477) a favorite surface of Sir Robert Ball, applied in his Theory of Screws, which itself may be looked upon as in part an application of non-Euclidean geometry, also the Cylindroid of Frézier (§§ 333, 360, 489), the corne de vache (§ 361, 475-6), and some special helicoids (§ 480-4), and has also covered the Third Angle (or 'shop') Method of employing descriptive geometry, and given a very full treatment of development (§ 405-20). The mathematical surfaces are beautifully illustrated.

The general plan of the book, while providing a comprehensive graphical training in the form of a progressive course, admits of specialization, of shorter courses, with noticeable flexibility. In fact, eight subgroupings are indicated for independent courses. Comparison with the special treatises scrupulously cited shows the extent of matter on all topics usually treated to be surprisingly great. Professor Willson has a gift for condensing without loss of clearness. With this power, he does well to restate for convenient reference many of the fundamental definitions which he presumes already in some form previously mastered, for example the definition of the trigonometric functions on page 31.

But I still prefer the definition in the note on page 121, "a straight line is the line which is completely determined by two points," to the author's second thought given in the preface, "the line that is completely determined by any two of its points." The spheric space of non-Euclidean geometry, though movable as a whole in itself, is such that two geodetic lines in it always cut in two points. Of course no spherical trigonometry is employed in the author's solution of the problems of trihedrals, pure a graphic process, as it should be. We are glad to find as an appendix the brief but very weighty paper on Trochoids which was so highly and justly praised when presented to the American Association for the Advancement of Science. We cannot forbear to dwell upon the superb illustrations, which make the book a portfolio of art. The author is particularly happy in deciding conflicts of nomenclature, as where he refuses to follow Javary (§ 508) in calling the geodesic on a cone a conical helix.

The author has been extraordinarily painstaking in the proof-reading, and the book is practically free from error. A few trifles have been noticed—

Page 165, § 433, first line, for "prism" read "cylinder."
Page 171, § 442, first line, for "axes" read "bases."
Page 37, sixth line from below, for 90° read 9°
Page 67, § 194, seventh line, for ϕ read θ.

The slip on page 55, § 166, in stating the brachistochrone and tautochrone properties of the cycloid is so evidently a reference to a reversed or inverted figure inadvertently omitted that it also is trivial.

As to the briefest hint of contents by chapters: I. Definitions, classification. II. Free-hand sketching. III. Draughtsman's outfit. IV. Use of instruments. V. Higher plane curves. VI. Conventional representation. VII. Lettering. The treatment of lettering is particularly full, and sixty-four alphabets are given. VIII. Copying processes. IX. Descriptive geometry of Monge. X. Projections, intersections, development of surfaces, with applications to elbow joints, blast pipes, arch construction, &c. XI. Trihedrals. XII. Projection of sphere. Here the now disused orthographic projection is somewhat condensed, but the stereographic, which is used, is far more complete than in Church. XIII. Shades and shadows. XIV. Perspective. XV. and XVI. Isometric and Clinographic projection, with applications; also, crystals in oblique projection. XVII. Bridge details, toothed gearing, &c. Out of a host of beautiful figures, we may mention 92 as particularly efficient in teaching homology or *complete plane perspective.*

It is a particular pleasure to welcome this book, because it is on just the lines where English and American mathematics has hitherto been sterile.

Even now, the tremendous, the fundamental importance of von Staudt's geometry of position, the pure projective geometry, both for science and philosophy, is realized by few. For example, in the Bolyai type of non-Euclidean geometry, not only is the straight line infinite, but also it has two distinct points at infinity; it is never closed, even by points at infinity. Writing in 1835, even the superhuman penetration of Lobachévski attributed this essential openness to the straight in itself. In the introduction to his "New Elements of Geometry" he says: "I consider it unnecessary to analyse in detail other assumptions too artificial or arbitrary. Only one of them still deserves some attention; namely, the passing over of the circle into a straight line. Moreover, here the fault is visible from the beginning in the violation of continuity, when a curve, which does not cease to be closed, however great it may be, must change immediately into the most infinite straight line, since in this way it loses an essential characteristic.

In this regard the imaginary geometry (the non-Euclidean geometry) fills out the interval much better. When in it we increase a circle all whose diameters come together at a point; finally, we so attain to a line such that its normals continually approach, although they no longer can cut one another. This characteristic does not pertain to the straight, but to the curve, which, in my paper "On the Foundations of Geometry," I have called *circle-limit.* Of course, it was not until in the next decade (1847) that von Staudt published his immortal "Geometrie der Lage, but long afterward Helmholtz suffers still more seriously for lack of the pure projective geometry, treating the projective questions which necessarily came up in his extended optical researches, sometimes by means and methods of his own make; sometimes only by general reasonings.

Again in *Mind* (1876) Helmholtz misses thus a fundamental difference. He says, p. 315: "It is in fact possible to imagine conditions for bodies apparently solid such that the measurements in Euclid's space become what they would be in spherical or pseudo-spherical space. * * * Think of the image of the world in a convex mirror. * * * Now, Beltrami's representation of pseudo-spherical space in a sphere of Euclid's space is quite similar, except that the background is not a plane, as in the convex mirror, but the surface of a sphere, and that the proportion in which the images as they approach the spherical surface contact, has a different mathematical expression."

But in reality these differences are so fundamental as to make all the difference between Euclidean and non-Euclidean; for the changed measure for distance in the mirror world is still Euclidean, parabolic, using an imaginary conic in the plane background as "absolute" in Cayley's sense. Thus Helmholtz repeated, reproduced the old, but false, theorem that in space of positive curvature two geodetic lines, if they in general cut, must necessarily cut in *two* points. He never attained the conception of single elliptic space, the type-form, but speaks only of "spherical space of three dimensions."

It is to be hoped that Professor Willson's book may hasten the day in America when courses in descriptive geometry and pure projective geometry, no longer confined to science schools, may be available in every college, and when there may be a more adequate realization of the power of spatial imaging as an instrument in scientific research.

Austin, Texas. DR. GEORGE BRUCE HALSTED.

New Psychology. By John P. Gordy, Ph. D., LL. D., Head of the Pedagogical Department of the Ohio State University. 8vo. Cloth, 402 pages. Price, $1.25. New York: Hinds & Noble.

This is the best elementary Psychology that has yet appeared. The plan of this work is the same as that of Dr. Gordy's "Lessons in Psychology," a book published in 1891 and, probably, read by a larger number of teachers than any similar work on the subject. The New Psychology is entirely rewritten, and the subject is treated in a simple, clear and philosophical manner. It should be in the hands of every teacher who desires to acquire a good working knowledge of the development and activity of the human mind. B. F. F.

Mechanical Drawing. By J. C. Tracy, C. E., Instructor in the Sheffield Scientific School of Yale University. 1898. New York: Harper & Brothers.

This book affords an excellent introductory course. Its aim is to prepare the student for a more extended course in any one of the special lines of drafting. It is comprehensive enough for use in schools and colleges, and, at the same time, is admirably suited to the needs of the student who must study the subject with little, if any, help from a teacher. The book closes with a valuable chapter on Perspective by E. H. Lockwood, M. E., instructor in the Sheffield Scientific School. J. M. C.

Supplemento al Periodico di Mathematica. Diretto dal Dott, Giulio Lazzeri.

Étude sur le Triangle et sur Certains Points de Geometrographie. Par M. E. Lemoine, Ancien élève de l'École Politechnique, á Paris. Pamphlet 24 pages.

Reprint from the proceedings of the Edinburgh Mathematical Society, Vol. XIII.

*Elementi di Geometria.*By G. Lazzeri e A Bassani Professori nella R. Accademia Navale, Livorno, Italia. Large 8vo, paper covers, 380 pages.

This work is divided into five books. Book I contains five chapters. Chapter I treats of lines and planes; chapter II, of segments, angles and dihedrals; chapter III, first notions on circles and spheres; chapter IV, parallel lines and parallel planes; chapter V, lines and planes perpendicular. Book II contains four chapters. Chapter I treats of polygons; chapter II, of solid angles; chapter III, of polyhedria; chapter IV, of distances. Book III contains four chapters. Chapter I treats of the relation between lines, planes and spheres; chapter II, of relations of polygons with circles and of polyhedria with spheres; chapter III, of geometry of the sphere; chapter IV, of surfaces and solids of revolution. Book IV contains seven chapters. Chapter I treats of the general theory of equivalence; chapter II, of the equivalence of polygons and of polyhedric surfaces; chapter III, of the equivalence of spherical polygons and spherical pyramids; chapter IV, of equivalence of prisms; chapter V, of the extent of limits; chapter VI, of the equivalence of polyhedra; chapter VII, of equivalence of circles and the three round bodies—sphere, cylinder and cone. Book V contains five chapters. Chapter I treats of the theory of proportion; chapter II, of homology and similarity; chapter III, of measurement; chapter IV, of the application of algebra to geometry.

From the above outline of the contents of this work, it is clear to be seen that the authors have not followed the old stereotyped order of presenting the subject of geometry, but have treated it in a wholly original manner. The figures of solid geometry are very artistic, representing, as near as it is possible for diagrams to do, the real spatial figure. The book contains 312 figures. At the end of each book there is a long list of theorems for original work, making a total of 1,067. B. F. F.

Mélanges Sur la Géométrie du Triangle. Par M. E. Lemoine, Ancien élève de l'École Politecnique, à Paris.

This paper was presented at the meeting of the French Association for the Advancement of Science, August 8, 1895. In this paper, Mr. Lemoine has derived many interesting properties of the triangle, and established a number of theorems in reference to the triangle and its relation to conic sections. In the Geometry of the Triagle, as studied from the modern point of view, Mr. Lemoine is the recognized leader and authority. B. F. F.

Yale Entrance Examinations in Mathematics. Compiled by Richard Mather, Ph. B. 1898. New Haven, Conn.: Boardman School Press.

This book contains the Yale entrance examinations in methematics from 1884 to 1898, and furnishes a very interesting and useful collection. The book will prove especially acceptable to preparatory and other schools where students are being fitted for college.

J. M. C.

Application de la Geometrographic a l'Examen de Diverses Solutions d'un même Problème. Par M. E. Lemoine, Ancien élève de l'École Politecnique, à Paris. Extract du *Bulletin de la Société Mathematique de France.* Pamphlet, 19 pages.

Questions Relatives a la Géométrie du Triangle, a la Geometrographie et a la Transformation Continue. Par M. E. Lemoine, Ancien éléve de l'École Politecnique, á Paris. Pamphlet, 32 pages.

A paper presented to the French Associatioa for the Advancement of Science, at its meeting April 3, 1896.

Integral Calculus. By Daniel Alexander Murray, Ph. D., Instructor in Mathematics in Cornell University. 288 pages. 1898. New York and Chicago: American Book Company.

This book is one of the Cornell mathematical series. While written primarily for use at Cornell, this text is admirably suited for any one beginning this study. The first two chapters, treating, respectively, of "integration, a process of summation" and "integration, the inverse of differentiation," are more extended than is usual in elementary works, and will prove an important aid to the student in gaining a clear idea of what the Integral Calculus is, and of the uses to which it may be applied. The subject matter is presented in a simple manner, but there has been no sacrifice of rigor of treatment. Chapters of more than ordinary interest are those on Integral Curves and on Ordinary Differential Equations. Many practical problems and illustrative examples are found throughout the book, while the appendix contains important additional matter. In short, the matter, contents and details of treatment characterize a well-constructed text-book, which is worthy the attention of teachers. J. M. C.

The American Journal of Mathematics, January, 1898, has the following leading papers: The Motion of a Solid in Infinite Liquid under no Forces, by A. G. Greenhill; Surfaces of Rotation with Constant Measure of Curvature and their Representation on the Hyperbolic (Cayley's) Plane, by Geo. F. Metzler; Sur les méthodes d'Approximations successives dans la Théorie des Equations différentielles, par Emile Picard. There is a frontispiece portrait of G. Darboux.

The American Monthly Review of Reviews. An International Illustrated Monthly Magazine. Edited by Dr. Albert Shaw. Price, $2.50 per year, in advance. Single number, 25 cents. The Review of Reviews Co., New York.

In history-making times like these a truthful record of passing events becomes an imperative need. The daily newspaper is ephemeral and not easily preserved for reference. The *American Monthly Review of Reviews* has all the value of the newspaper, besides distinctive merits of its own. As an epitome of current history it is complete, compact, terse, impartial, absolutely reliable, and judiciously edited. As a piece of journalistic history-writing, what could be more brilliant or fascinating than the May number of this publication, with its story of the Spanish-American war crisis? Merely as a souvenir of this past eventful month the *Review* has a certain unique fitness.

The Cosmopolitan. An International Illustrated Monthly Magazine. Edited by John Brisben Walker. Price, $1.00 per year in advance. Irvington-on-the-Hudson, New York.

One of the most popular literary magazines published in America.

The American Journal of Mathematics, for April, has three interesting papers, as follows: On the Focal Surfaces of the Congruences of Tangents to a given Surface, by A. Pell; Displacements Depending on One, Two and Three Parameters in a Space of Four Dimensions, by Thomas Craig; and, Further Researches in the Theory of Quintic Equations, by Emory McClintock.

The following periodicals have been received since the last acknowledgement: *Journal de Mathématiques Élémentaires*, (1er Mars, 1898); *The American Journal of Mathematics*, (January, 1898); *L' Intermédiaire des Mathématiciens*, (Fevrier 1898); *Miscellaneous Notes and Queries*, (Nov.-Dec., 1897); *Bulletin of the American Mathematical Society*, (February, 1898); *The Kansas University Quarterly*, (January, 1898); *The Monist*, (January, 1898); *The Literary Digest*, (January to March 19, 1898); *The Ohio Teacher*, (March, 1898); *The Educational Times*, (March 1, 1898); *American Journal of Mathematics*, (April, 1898); *L' Intermédiaire des Mathématiciens*, (Mars 1898); *Journal de Mathématiques Élémentaires*, (15 Mars 1898); *The Monist*, (April, 1898); *Bulletin of the American Mathematical Society*, (April, 1898); *The Mathematical Gazette*, (February, 1898); *The Educational Times*, (April, 1898).

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NOTES.

In a letter from Dr. Alexander Macfarlane, among other things he says:

The following extract from Dr. Laisant's book "La Mathématique: Philosophic Ensciguement" may encourage the editors of the MONTHLY.

Parmi toutes les nations du monde, il u' en est assurément par une plus intérsessante que les Etats-Uuis d' Amerique, au point de vue du développment rapide qu a pris ce pays, des progrés prodigieux de son industrie, de l' énergieet de l' initiative dont il a fait preuve. Mais tant d' activité obligée, imposeé à un pays neuf par les conditions de son existence, se concileait mal avec des recherches pureuant théoriques, avec la poursuite sentimentale de la verité pure. Aussi le nombre des mathématiciens Americains a-t-il été longtemps des plus reduits. Il y a environ vingt-cing aus, mon ami regretté J. Houël l' un des savants les instruits de sou temps, et dont l' érudition mathématique était immense, m' aître tenait dans une de ses lettres de la situation mathématique des diverses nations et arrivait a' cette phrase typique dont je n' ai jamais perdu le souvenir. "Quant aux Etats-Unis, ils importent juste la quantité de science pure que est necessaire à leur industrie."

C' était très' exact alors. Dupuis cette époque, au savant anglais, Sylvester, mort il y a peu de temps, fut appelé a professer a Baltimore; il y fonda un important journal mathématique, et provoqua une sorte de révolution intellectuelle à ce point de vue, en quelques années seulement. Aujour d' hui, la *Societé Mathematique Americaine* de New York comprend à peu près le même nombre